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Gemini Launch Vehicle Pilot Safety Program-AMR

25 JUNE 1963

Prepared by

NASA MANNED LAUNCH VEHICLE PROGRAM OFFICE

GEMINI

Prepared for COMMANDER SPACE SYSTEMS DIVISION

UNITED STATES AIR FORCE

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**GEMINI LAUNCH VEHICLE
PILOT SAFETY PROGRAM - AMR**

27 June 1963

Prepared by
NASA Manned Launch Vehicle Program Office,
Gemini

AEROSPACE CORPORATION
El Segundo, California

Contract No. AF 04(695)-169

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GEMINI LAUNCH VEHICLE

PILOT SAFETY PROGRAM - AMR

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The Gemini Launch Vehicle (GLV) Program will follow, generally, the Mercury/Atlas Pilot Safety Philosophy and Procedures used at the Atlantic Missile Range (AMR) and will incorporate applicable established operating procedures and practices developed for and during the Titan II Flight Test Program.

The GLV Pilot Safety Program, as established by SSD Exhibit 62-195 (Aerospace Report TOR-169(3126)-10) dated 11 January 1963, directs implementation of a Pilot Safety Program at the AMR. The prime objective of this program is to assure astronaut safety by achieving the flight readiness of a GLV incorporating the maximum inherent design reliability. A further objective of the program is to assure adequacy of the GLV Malfunction Detection System (MDS). Implementation of this program will also provide assurance for accomplishing the mission objectives. This document describes a contractual "task" for all associate contractors and agencies supporting the GLV program at AMR.

The GLV Pilot Safety Program at AMR will be implemented by: (1) a Quality Assurance effort, (2) a Flight Readiness effort, and (3) a Flight Safety Review. This will provide a continuous monitoring effort commencing at the time the initial launch vehicle arrives at AMR and continuing through to the final launch. The procedures for these efforts were developed as a result of Mercury experience and analysis of Gemini requirements.

The GLV Pilot Safety Program will encompass a thorough evaluation of the launch vehicle and its interaction with the launch complex (including AGE) and the Gemini Spacecraft.

The Program will include inspection and monitoring of tests of the launch complex, associated systems, and launch vehicle hardware and systems to determine their readiness. The mating of the launch vehicle and the spacecraft will be monitored, and an inspection will be conducted at the interface area. Checkout of spacecraft systems which might affect launch vehicle functions will also be monitored.

This document defines the coordination, documentation, procedures, inspections, and responsibility aspects of the Quality Assurance effort; the composition, responsibility, authority, and activity of the various teams involved in the Flight Readiness effort; and the Flight Safety Review Procedure.

3.0 ORGANIZATION AND RESPONSIBILITIES

3.1 The Gemini Launch Vehicle Working Group (GLVWG) is the resident technical team composed of senior representatives of SSD/Aerospace and all Associate Contractors: Martin/Marietta Corporation, Aerojet General Corporation, Burroughs Corporation and General Electric Company. In addition, NASA, Pan American Airways (PAA), Radio Corporation of America (RCA), Patrick Test Site Office (PTSO), and the Department of Defense (DOD), are represented. The meetings, co-chaired by SSD (the 6555th Aerospace Test Wing) and Aerospace Corporation/AMRO, will be held periodically. Technical problems, launch system status, and documentation will be the main topics of discussion. The group also will hold a post-flight critique and issue a T-plus-15 day flight report.

3.2 Figure 1 shows the pilot safety organization structure which will be used for the handling of the Gemini Launch Vehicle at AMR. The levels of this structure are Working Teams, Interface Committee, Active Review Team, Status Review Team, and Launch Vehicle Flight Safety Review Board. Appendix A presents typical Working Team Organization Assignments while Appendix B presents typical Pilot Safety Activities (GLV No. 1).

3.2.1 Personnel assignments will be made from the most qualified personnel available. A certification program shall be implemented to insure that those assigned have optimum knowledge of their functions and are qualified to perform their assigned responsibilities. To realize the optimum benefit from program activities it is mandatory that continuity be maintained through stability in the assignment of personnel.

4.0 QUALITY ASSURANCE EFFORT

4.1 GENERAL

The objective of the Quality Assurance effort is to assure that the quality, workmanship, and reliability (which have been incorporated into the GLV during preceding phases), and complete preceding documentation are maintained throughout the AMR Activities. This effort will embrace all GLV hardware (including AGE and launch facilities) and documentation, and includes the selection, identification, handling, storage, and documentation of spare parts for the GLV.

4.2 SUPPORT TO THE FLIGHT READINESS EFFORT

The Quality Assurance Program at AMR will support the Flight Readiness Effort, as described in Section 5.0, in the following areas:

- a. Configuration Control
- b. Documentation
- c. Status of Vehicle Testing
- d. Reliability
- e. Receiving Inspection
- f. Inspection Documentation
- g. Maintenance of a Time History for each GLV Time Sensitive Component

4.3 SPARES SUPPORT

4.3.1 General

Project Gemini will receive both common and program-peculiar spares support from the R & D single-spares concept. Under this single-spares inventory

4.3.1 (Continued)

concept, a complete separate Gemini inventory will not be required. However, it will be necessary to control critical components separately for Gemini. These critical components are listed in LV-52. This list will be revised, as required, to keep it current with program and component changes.

4.3.2 Spares Provisioning

A components support table will be developed by Associate Contractors which will list the prime (mandatory) spares requirements for the Gemini Launch Vehicle, (See LSD 1-423). This table will be revised, as required. Requirements other than the critical components listed in the support table will be submitted by the Contractors. A complete spares inventory, as specified by the applicable Contractor spares provisioning documents, will be maintained. A physical inventory of the Gemini critical components will be made monthly by the Martin Co. and PTSO personnel. Shortages will be replenished prior to the arrival of a Gemini launch vehicle at AMR and stock levels will be maintained thereafter until launch.

4.3.3 Identification and Storage

All critical spares which are for support of the Gemini Program will be identified serially and by the special Gemini decal. These critical spares will be stored at AMR in a separate, bonded area. The records and data used to certify Gemini critical component spare parts will accompany the respective spare parts to AMR. Components which bear the Gemini decal may not be used on other Titan missiles.

4.3.4 Replacement Criteria

Replacement for critical components must be selected from spares which are identified: 1) serially, 2) by a Gemini decal on the article, 3) by its corresponding log sheet, and 4) by its operational time and life record, if applicable.

4.3.4 (Continued)

Replacements for non-critical components may be selected from the R and D single spares inventory. However, the failure history of the component will be reviewed prior to installation.

A record will be kept of part numbers and serial numbers of all components removed and installed on the GLV for submittal to the Active Review Team for inclusion in the AMR history.

4.3.5 Spares Status Report

A report covering the physical inspection of spares inventory (Reference Paragraph 4.3.2) will be submitted by the Contractor, approved by the PTSO, to the Active Review Team immediately after vehicle arrival at AMR.

4.4 AGE AND FACILITY CONTROL

After completion of the Ground System Test Procedures or FACI, as applicable, for Complex and AGE acceptance, the Contractor will establish and maintain a controlled and sealed status of all AGE and certain designated facility items. Subsequent entry into sealed units shall require proper authorization, which will be initiated only by the Contractor's Inspection personnel after approval by the 6555th ATW. Prior to the start of work, authenticated signatures will be affixed to the authorization form by designated representatives of the Contractor's Quality Control, PTSO, and the Associated Contractor when an Associate Contractor's equipment is involved. A PTSO Representative will assure that all rework has been accomplished according to the approved documentation prior to re-sealing the unit.

4.5 AIRBORNE EQUIPMENT CONTROL

Access to airborne equipment will be controlled in a like manner to AGE and Facilities according to Item 4.4 above. That is, GLV access panels will be maintained in a sealed condition and opened only by proper authorization. Rework of the GLV will likewise be handled by proper authorization.

4.6 RELIABILITY

4.6.1 Failure Data and Hardware Control

All discrepancies or deviations from test or hardware specifications must be recorded on the appropriate Contractor form. All discrepancies for airborne components will be recorded on the Martin form.

All reported discrepancies that pertain to a Gemini Launch Vehicle must have corrective action satisfactory to the appropriate Working Teams and the Interface Committee, if applicable, prior to a launch. A failure analysis must be conducted prior to rework on all failed hardware that could affect mission success.

4.6.2 Reliability Problem Concurrence

Reliability problems are identified from failure reporting, failed parts analysis, reliability design analysis, testing and other information that indicates the need for corrective action to ensure mission success. After analysis and resolution of an identified failure by the appropriate contractor, the failure analysis report will be provided to the 6555th ATW/Aerospace/AMRO by SSD/Aerospace Program Offices.

The Working Teams must have satisfactory assurance that the reliability problems could not prevent a successful countdown and launch.

4.6.3 Time Sensitive Component Control

To prevent the use of over-age components on a Gemini Launch Vehicle for a flight, specific time/cycle sensitive components may require replacement prior to launch. These items are identified in Table 1.

Table 1 will be expanded and updated as required.

5.0 FLIGHT READINESS EFFORT

5.1 GENERAL

The Flight Readiness effort will provide positive control over AMR GLV activities (including the spacecraft interface), and will determine the flight readiness of the launch vehicle and its compatibility with the launch complex, AGE, and spacecraft. Included in this effort are activities of the Working Teams, Interface Committee, Active Review Team, and the Status Review Team.

5.2 WORKING TEAMS

Activities at the working level are divided into areas such as airframe, propulsion, electrical, etc., per Appendix A. A team will be assigned to each area. Typically, a team will consist of a representative from each of the following organizations: Aerospace/AMRO, 6555th ATW, Patrick Test Site Office (PTSO), and appropriate Associate Contractor(s). NASA representatives are invited as observers during the working team activities. The Chairman of each team will be the Aerospace/AMRO member who will submit the findings and/or recommendations to the Active Review Team (ART). It will be the responsibility of these teams to observe and monitor activities in their respective areas, to analyze results of all tests and progress of the launch program, and to review and sign off procedures upon their completion. The teams will also make recommendations to the ART regarding problems encountered during testing. The Chairman will document all working team meetings, and submit reports.

5.3 INTERFACE COMMITTEE (SPACECRAFT/GLV)

This team will consist of AMR representatives from NASA, 6555th ATW, Aerospace, McDonnell, Martin/Marietta, and PTSO. The NASA member will be the Chairman. The functions of the team will be to assure quality of workmanship, correctness of applicable drawings, and to assure that the interface area is clear of any defects, debris or interference which could jeopardize the flight. The Chairman will keep the minutes of the interface committee meetings, and the minutes may be reviewed by all organization representatives before distribution. Courtesy copies of these minutes will be submitted to the Active Review Team for inclusion in the GLV History.

5.4 ACTIVE REVIEW TEAM

The Active Review Team will consist of representatives from the 6555th ATW, Aerospace/AMRO and PTSO. The Chairman of this team will be the Aerospace/AMRO member. The functions of the team are to review and document continuously the overall progress of the launch vehicle and AGE/Facility including all subsystem areas; to maintain the launch vehicle history; to ensure that work is in accordance with the basic philosophy of the Pilot Safety Program; and to form the working teams as required (See Appendix A). The Active Review Team will ensure that each working team Chairman submits requisite reports. The Chairman will prepare and distribute Active Review Team minutes of meetings.

5.5 STATUS REVIEW TEAM

This team will consist of representatives from the GLVWG membership, SSD and Aerospace/LA. The Chairman of this team will be the 6555th ATW member. The final status review function will be performed by the Status

5.5 (Continued)

Review Team prior to the Flight Safety Review. At this time, the Status Review Team will review history of the launch vehicle from its arrival at AMR. This Team then will determine the technical readiness of the launch vehicle for flight and of the AGE/Facilities to support the launch. The Status Review Team will ascertain that all possible efforts have been made to ensure a successful mission, that the launch vehicle is in the best possible condition of technical readiness, and that any reservations on the parts of participating agencies have been considered. Minutes of the Status Review Meeting will be approved prior to adjournment. These minutes will serve as the basis for a final status report to be presented to the Launch Vehicle Flight Safety Review Board.

6.0 FLIGHT SAFETY REVIEW

6.1 GENERAL

The Flight Safety Review, as conducted by the Flight Safety Review Board (FSRB), will constitute the final, focal point activity of the Pilot Safety Program. The FSRB will satisfy itself as to the status of the launch complex, AGE, and GLV (including the GLV-spacecraft interface), and will make the ultimate decision as to whether or not to commit the GLV to launch. While NASA may decide at any time to cancel the launch, no agency may commit the GLV to launch without the approval and concurrence of the FSRB.

6.2 FLIGHT SAFETY REVIEW BOARD (FSRB) ACTIVITY

The FSRB will be composed of the following or their designated representatives:

- Chairman - Commander, SSD
- Members - Deputy for Engineering, SSD
Commander, 6555th Aerospace Test Wing
President, Aerospace Corporation
Director, Aerospace/AMRO
- Observers - DOD Representative
NASA Team (to include the Operations Director
and an Astronaut)
- Recorder - Furnished by GLV Directorate, SSD

The FSRB will assemble in the morning of F-1 day or as directed by the Chairman, to conduct the Flight Safety Review. The SSD Program Director will prepare and/or coordinate a presentation to the FSRB to include the following:

- a. Significant details of previous GLV and Titan II Launches.
- b. Modifications to hardware, profile, and procedures since previous launch (or since previous review by the FSRB).
- c. History of the GLV through production, acceptance, and transportation to AMR.

(6.2 Continued)

- d. History of the GLV at AMR.
- e. Report and recommendations of the GLV Status Review Board.
- f. Complete technical review of the significant problem areas.
- g. Report on personnel changes of the launch crew and the flight readiness teams.

Following the presentation, the Chairman will provide an opportunity for hearing dissenting or qualifying statements. The FSRB will then decide whether or not to commit the GLV to launch, and present this decision to the senior NASA representative for his concurrence or rejection. The NASA and DOD Observers are invited to participate fully in the above Review to assure themselves as to the GLV status and all associated ground equipment.

7.0 PROCEDURES

7.1 GENERAL

The Chairman of the applicable working team or board, and PTSO will ensure that full use, where applicable, will be made of established techniques, operating practices, and procedures developed for the Titan II R and D flight test program and presently being used in Titan launch operations. Applicable Mercury procedures will also be utilized.

7.2 TEST PROCEDURES

All test procedures and PCN's (Procedure Change Notices) prior to use will be reviewed by 6555th ATW/Aerospace to establish their technical adequacy. When the technical adequacy has been established, working teams will ascertain that tests were completed satisfactorily in accordance with the appropriate test procedures, and that the test procedures and associated data are reviewed and signed off. Testing normally will be witnessed by PTSO. Certain tests, as required, will be witnessed by the 6555th ATW and/or Aerospace/AMRO.

The Active Review Team will assign the level of effort for the working teams in reference to test procedure reviews and follow-up. A review will fall into three categories:

- a. Those where it is necessary only to assure that the tests were completed and signed off by inspection of the appropriate inspection log.
- b. Those where the test procedure and associated data are to be reviewed and signed off by the working team upon satisfactory completion of a test.
- c. Those where, in addition to b., the testing must be witnessed by 6555th ATW/Aerospace/AMRO.

7.3 CONFIGURATION CONTROL

It is mandatory that the vehicle configuration integrity be maintained during the AMR portion of the program. Any removal and/or replacement of components must be 1) approved by the 6555th ATW, and 2) properly documented as defined in Gemini CCB Instructions.

SSD Configuration Control Board (CCB) approved changes shall be programmed and controlled for implementation by the AMR GLV Configuration control activity working in coordination with the SSD CCB.

All AMR originated changes will be comprehensively reviewed for completeness and transmitted through the AMR GLV configuration control activity.

The AMR GLV configuration control activity will be responsible for supplying raw data inputs to the Gemini Configuration Index (GCI).

No critical components will be removed from Gemini Launch Vehicles to support other Titan flights.

8.0 REPORT REQUIREMENTS

8.1 WORKING TEAMS

Each working team shall submit a weekly technical report to the chairman of the Active Review Team, beginning with the arrival of the launch vehicle at AMR. This report shall be on reproducible format for ease of inclusion in the launch vehicle History Log. Each working team chairman shall maintain an up-to-date log which will include the results of reviews of all MARS, reliability problems, and Test Procedures. Whenever serialized components are replaced, a complete record of the serial numbers shall be entered in the log.

8.2 INTERFACE COMMITTEE

Copies of the minutes of each meeting of the Interface Committee will be submitted to the Active Review Team for review and inclusion in the launch vehicle history.

8.3 ACTIVE REVIEW TEAM

The Active Review Team will be responsible for the preparation of the summary report covering the history of the launch vehicle from arrival at AMR until the launch preparation cycle is completed.

8.4 STATUS REVIEW TEAM

The Status Review Team will issue a Technical Readiness Report and recommendations, signed by all members, at the conclusion of the Pre-launch Status Review Meeting.

9.0 POST-LAUNCH ACTIVITIES

9.1 NORMAL

After a normal launch, it will be the responsibility of all Contractors to review the countdown and appropriate flight data and report their findings to the Launch Test Controller, 6555th ATW, at the GLVW post flight critique.

9.2 ACCIDENTS

In the event of major launch abnormalities, and especially in the case of flight failure of the GLV, the chairman of the Flight Safety Review Board will immediately reconvene the FSRB at AMR. This board will review the abnormality and decide on an investigatory course of action. The FSRB will normally convene the Manned Flight Surveillance Board (MFSB), defined in AF Exhibit 62-195, Section 4.3, and direct its scope and activity. NASA will be invited to participate fully as an observer during any investigations by the MFSB or the FSRB.

TABLE 1
COMPONENT REPLACEMENT REQUIREMENTS

Component	Mandatory Review	Mandatory Replacement Time/Cycles
Three Axis Reference System	300 hours	To be supplied later.
Rate Gyro	300 hours	
Autopilot	300 hours	
Adapter Package	150 hours	
Malfunction Detection Package	150 hours	
Rate Switch Package	150 hours	
Inverter	210 hours	
Rate Beacon	80 hours	
Pulse Beacon	100 hours	
Decoder	350 hours	
Electric Motor Driven Hydraulic Pump	----	
APS/IPS Battery	----	
Destruct Battery	----	

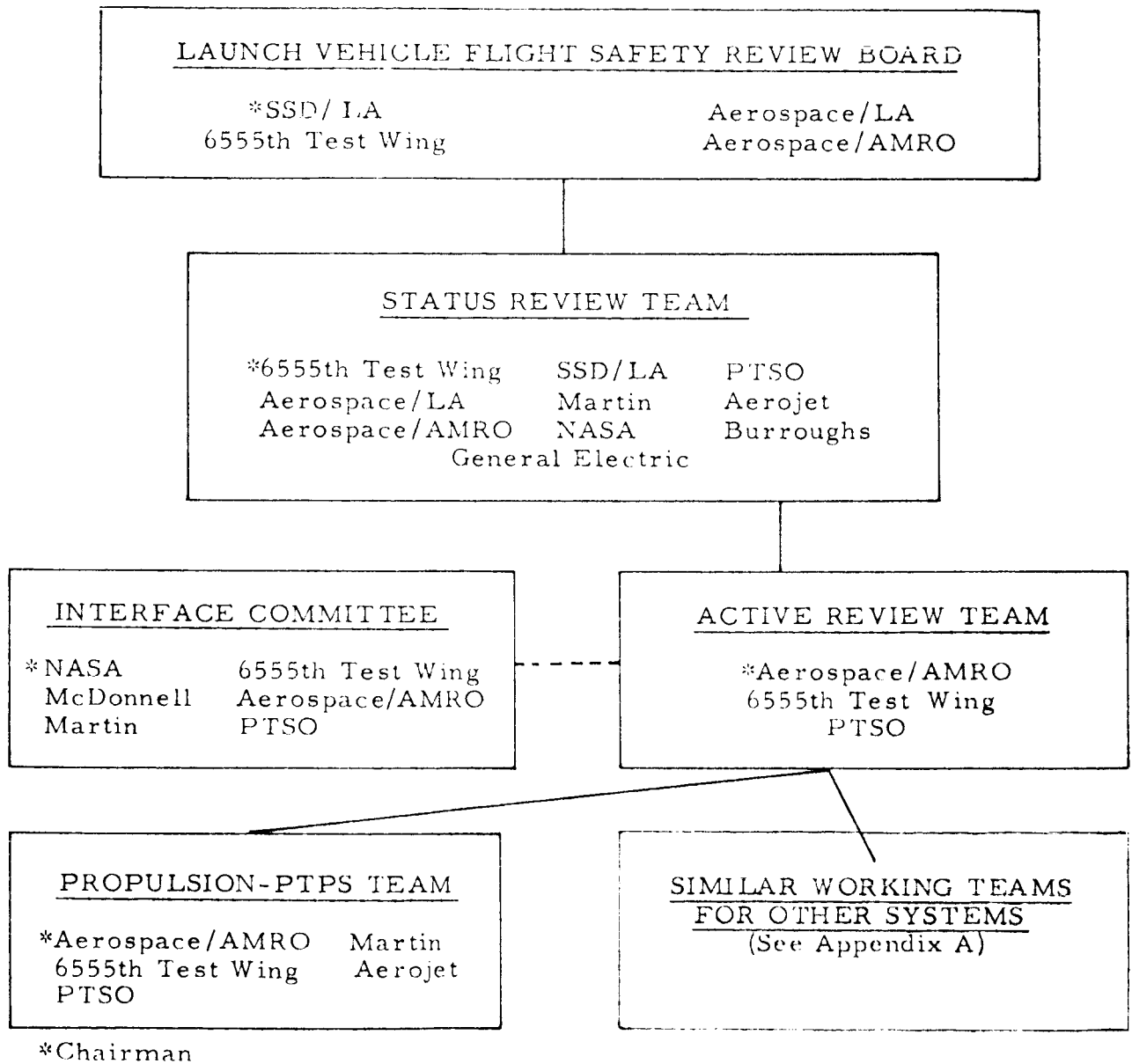


Figure 1 - Organizational Structure

APPENDIX A

TYPICAL WORKING TEAM ORGANIZATION ASSIGNMENTS

Propulsion-PTPS Team

Aerospace/AMRO
6555th ATW
PTSO
Martin
Aerojet

Airframe

Aerospace/AMRO
6555th ATW
PTSO
Martin

Launch Vehicle Electrical

Aerospace/AMRO
6555th ATW
PTSO
Martin

Guidance Systems

Aerospace/AMRO
6555th ATW
PTSO
Martin
PAA
Burroughs
GE

Flight Control and Hydraulics

Aerospace/AMRO
6555th ATW
PTSO
Martin

AGE

Aerospace/AMRO
6555th ATW
PTSO
Martin

Launch Vehicle Safety System

Aerospace/AMRO
6555th ATW
Martin
GE

MDS-PMDS System

Aerospace/AMRO
6555th ATW
PTSO
Martin

Telemetry/Airborne Instrumentation

Aerospace/AMRO
6555th ATW
PTSO
Martin

Landline Instrumentation and BLH

Aerospace/AMRO
6555th ATW
PTSO
Martin

Explosives and Pyrotechnics

Aerospace/AMRO
6555th ATW
PTSO
Martin
PAA

Facilities

Aerospace/AMRO
6555th ATW
PTSO
Martin
PAA

NOTE: Aerospace/AMRO representatives will act as chairmen of the working teams.

APPENDIX B

TYPICAL PILOT SAFETY ACTIVITIES (GLV No. 1)

1. Arrival AMR - Handling and Transport
2. Receiving Inspection
3. Erection (SCF Configuration)
4. Initial Power-On Checks
5. Sub System Function Verification Tests (SSFVT's)
6. Combined System Test (CST)
7. All Systems Test (AST) - SCF Configuration
8. CST
9. SCF
10. Post SCF Analysis
11. Erect Stage II to Tandem Configuration
12. Initial Power-On CKS-Stage II
13. SSFVT's
14. CST
15. AST - Launch Configuration
16. CST (Includes S/C and GLV EEI and RFI)
17. FRF
18. Post FRF Analysis
19. SSFVT's
20. CST
21. F-3 Day-Dry Mock/Simulated Flight Test
22. F-2 Day - (DMSFT Data Analysis)
23. F-1 Day (Launch Preps)

NOMENCLATURE

AGE	- Aerospace Ground Equipment
AMR	- Atlantic Missile Range
AMRO	- Atlantic Missile Range Office
ART	- Active Review Team
AST	- All Systems Test
CCB	- Configuration Control Board
CST	- Combined System Test
DMSFT	- Dry Mock Simulated Flight Test
DOD	- Department of Defense
EEI	- Electrical/Electronic Interference
FRF	- Flight Readiness Firing
FSRB	- Flight Safety Review Board
GCI	- Gemini Configuration Index
GLV	- Gemini Launch Vehicle
GLVWG	- Gemini Launch Vehicle Working Group
MARS	- Martin Automatic Reporting System
MDS	- Malfunction Detection System
MFSB	- Manned Flight Surveillance Board
PAA	- Pan American Airways
PCN	- Procedure Change Notices
PMDS	- Pad Malfunction Detection System
PTSO	- Patrick Test Site Office

NOMENCLATURE (Continued)

RCA	- Radio Corporation of America
RFI	- Radio Frequency Interference
SCF	- Sequence Compatibility Firing
SSFVT	- Sub System Function Verification Tests

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